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(54) Manufacture of a profiled plain bearing element

(57) A wound wide strip, composed of a steel backing and a laminar material applied thereon, is by longitudinal cutting formed into strips (2) in the form of individual coils (4, 5, 6) and then is longitudinally profiled and processed into plain bearing elements.

The profiling machine (8) is situated downstream of the station for longitudinal cutting (not shown) and includes chamfering stations (12, 13) and downstream thereof a follow-up machine with measuring devices.

The longitudinally cut strips (2) are brought to the profiling stations (12, 13) as a block (11) of coils. At least one profiling is made on the steel backing and then at least one profiling on the side of the strip with the laminar material. The profiled strip (2) is then processed into plain bearing elements; these are measured immediately after their production for tolerance accuracy so that, according to the result of the measurement, the profiling of the strip (2) can be altered.

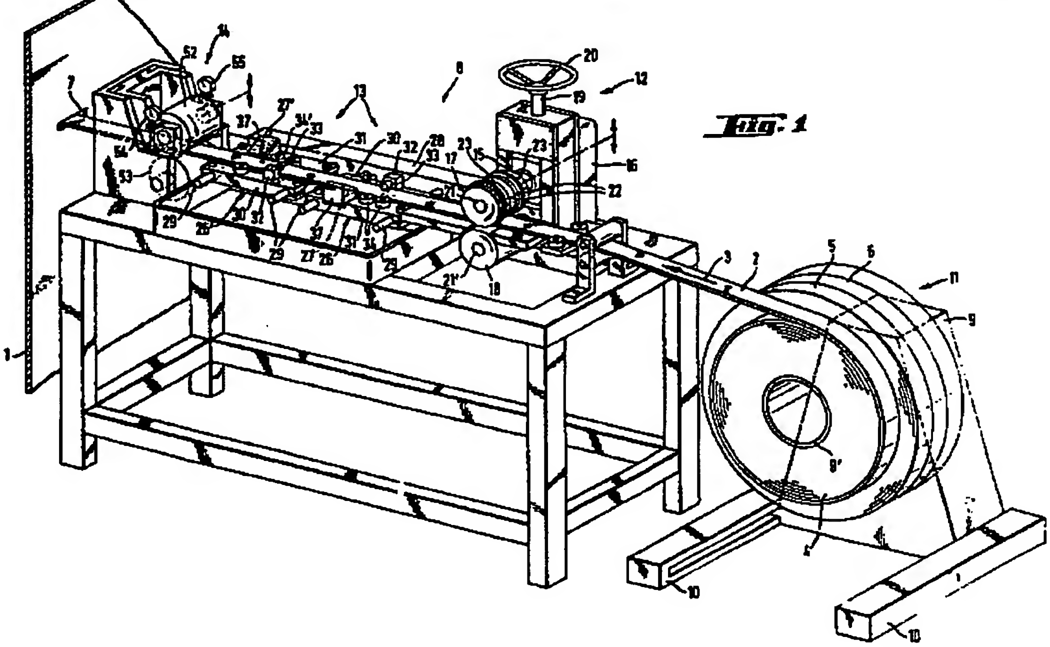

Fig. 1

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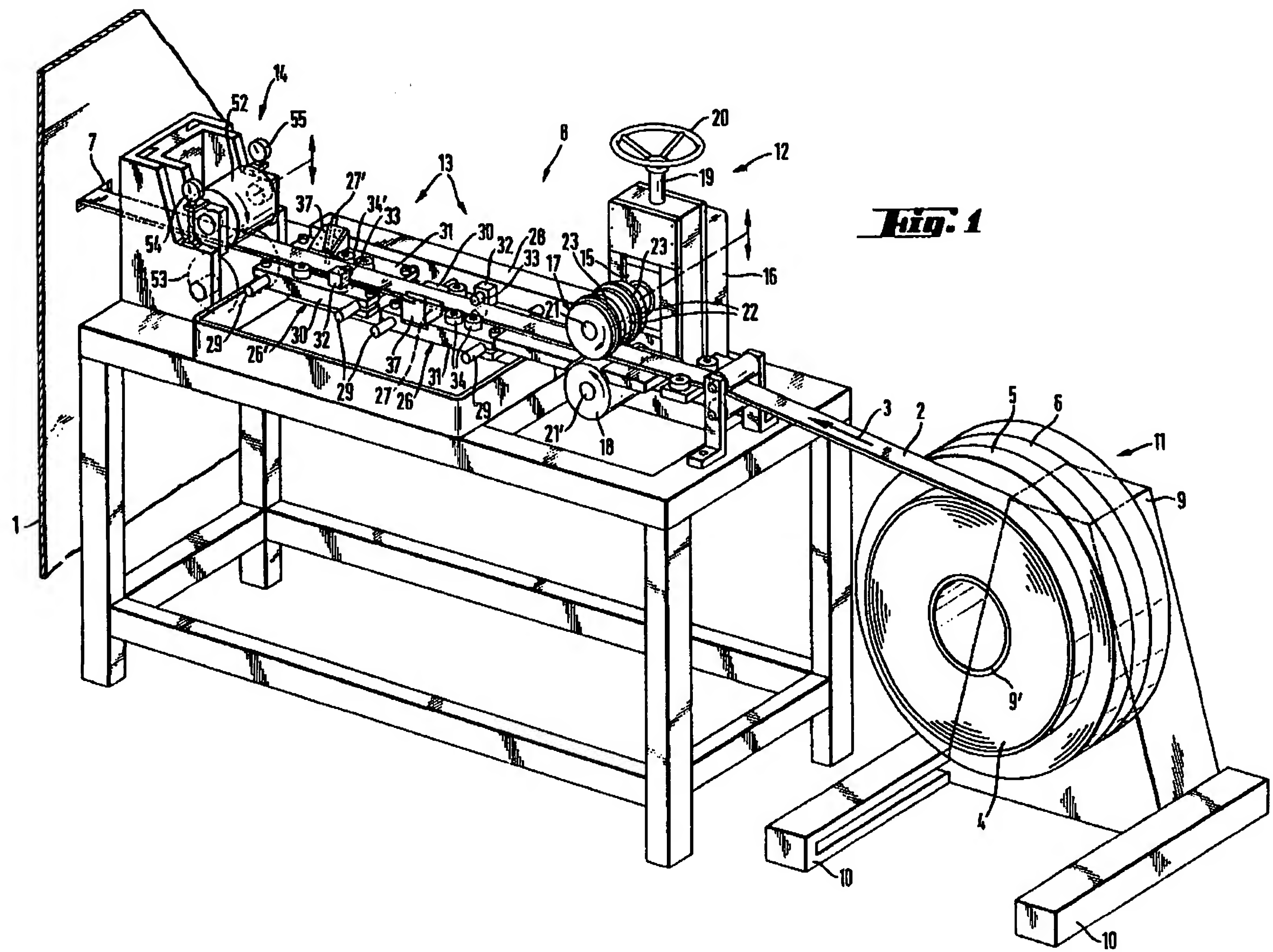
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Fig. 1

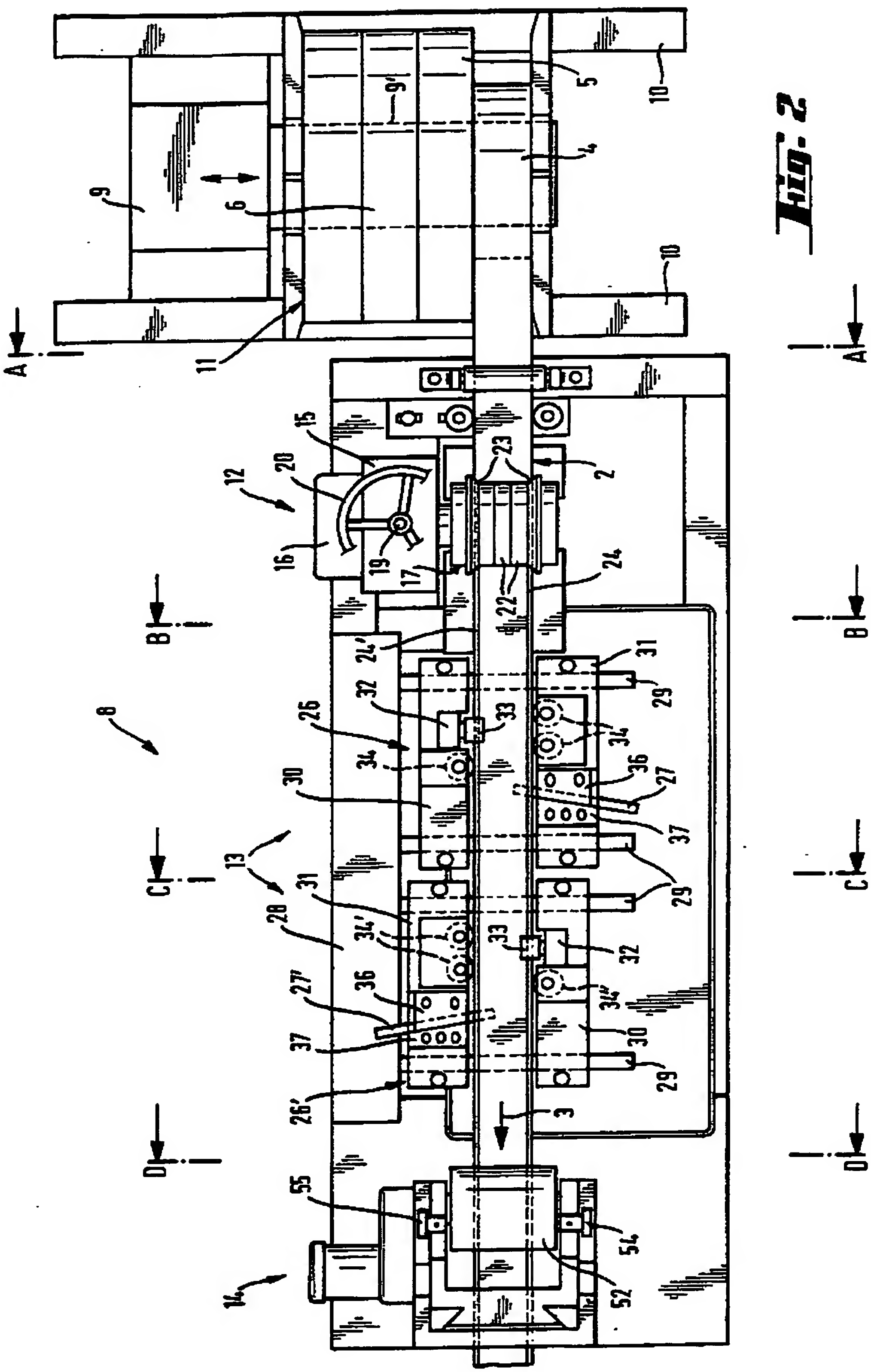
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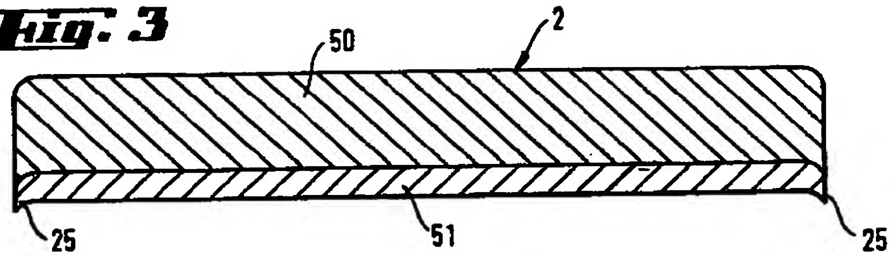
Fig. 2

Fig. 3



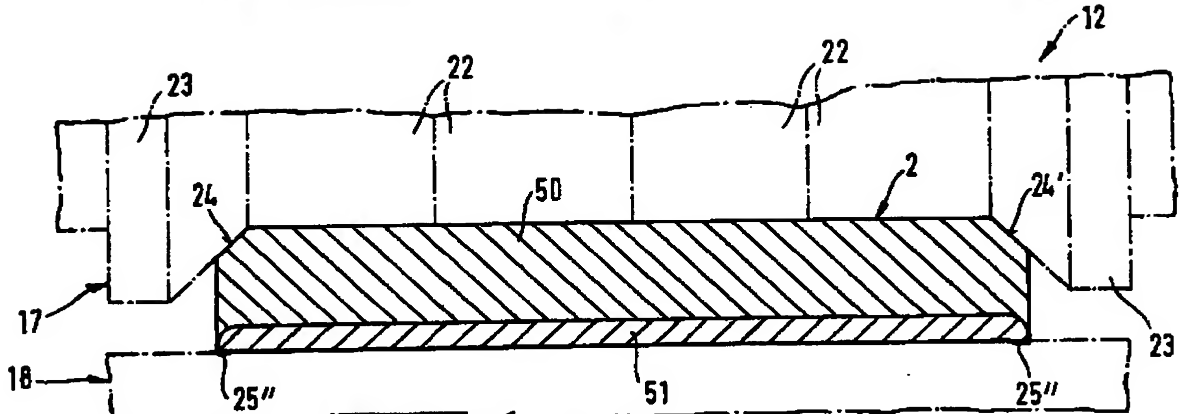


Fig. 4

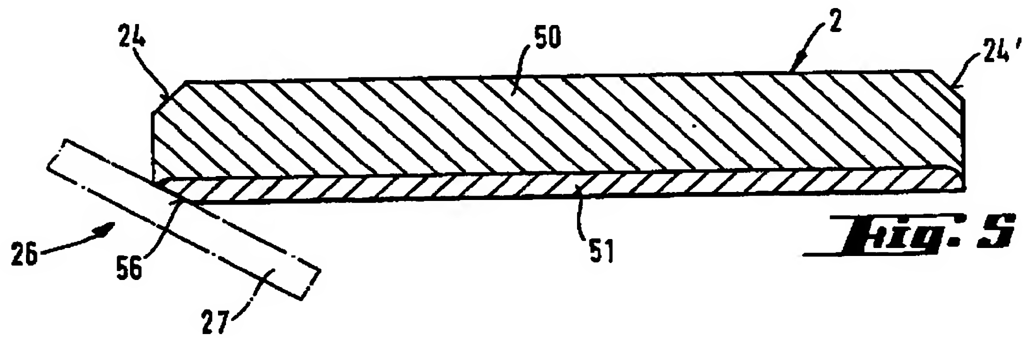


Fig. 5

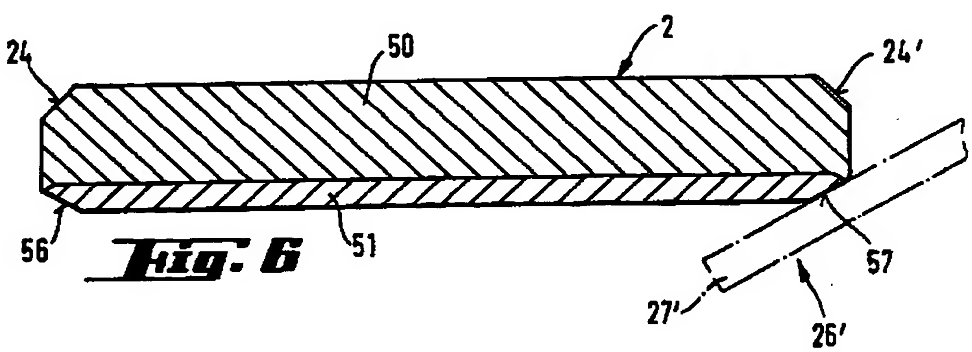


Fig. 6

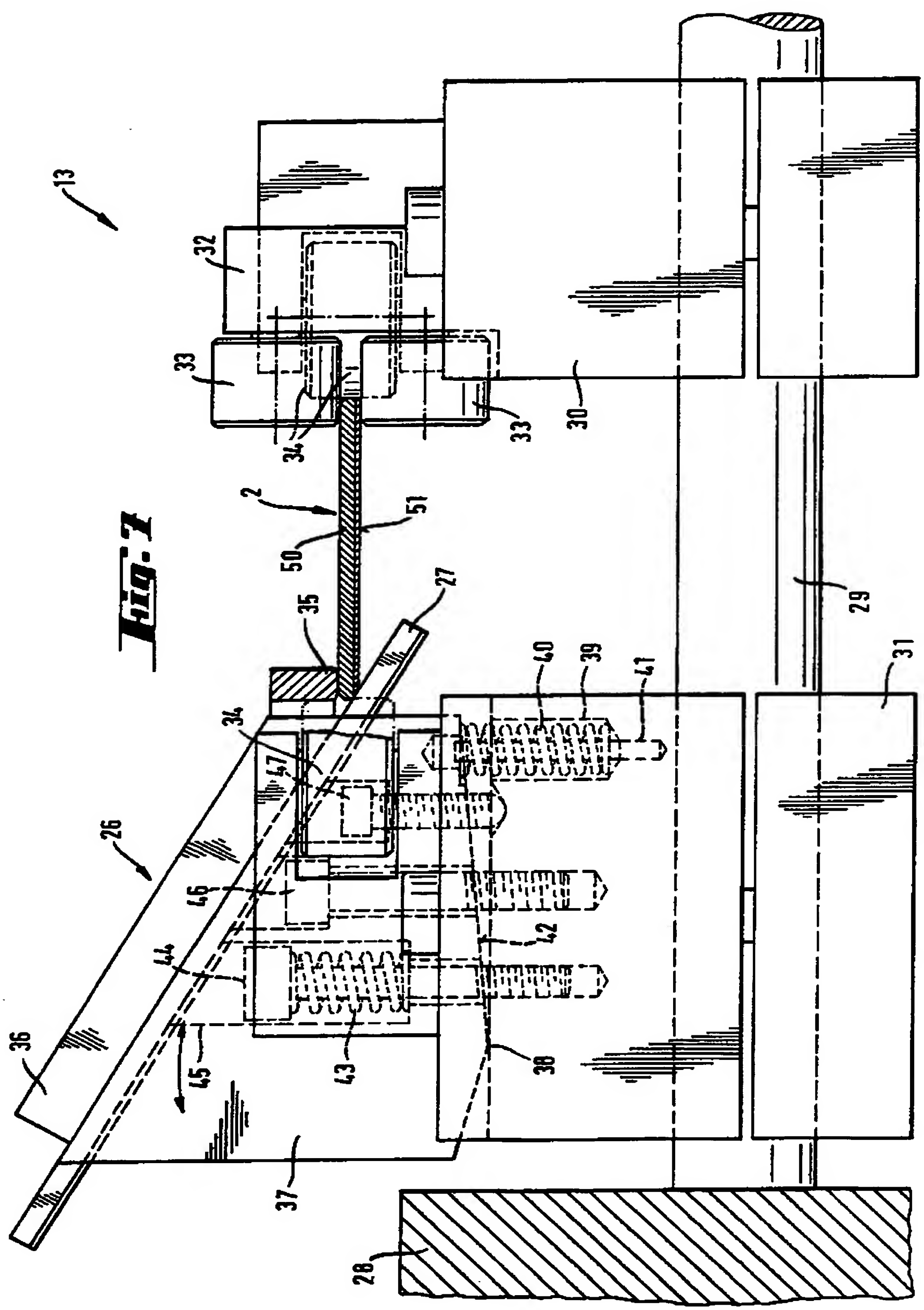

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Fig. 7

A METHOD FOR THE MANUFACTURE OF A PROFILED PLAIN BEARING ELEMENT AND AN APPARATUS FOR CARRYING IT OUT

The invention relates to a method for the manufacture of a profiled plain bearing element in which a coiled wide strip, composed of a steel backing and a laminar material applied thereon, is by longitudinal cutting formed into strips in the form of at least two coils and is then on at least two longitudinal edges profiled and processed into plain bearing elements.

The invention also relates to an apparatus for the manufacture of a profiled plain bearing element, in which, in a station for longitudinal cutting, a coiled wide strip, composed of a steel backing and a laminar material applied thereon, is formed into strips in the form of at least two coils and in which at least two longitudinal edges are profiled, the apparatus comprising a profiling machine, which is situated, in the direction of processing, downstream of the station for longitudinal cutting and contains chamfering stations including a chamfer rolling station and a cutting station with cutting knives, a follow-up machine situated downstream of the profiling machine, and measuring means for the measurement of the finished plain bearing elements.

It is useful, for better insertion of plain bearing elements, particularly bushes, in the relevant holes or journals, to provide each plain bearing element outwardly and/or inwardly with a chamfer. This can be made, in principle, in a lathe on the finished element, but the expenses associated with this has already been considered to be too high and not justifiable. The practice was therefore adopted to provide the strip, from which the plain bearing element is eventually made, with the necessary chamfering, because the chamfering could be made continuously and economically. It was found that by the wrapping or forming of the relevant strip por-

tion to form the bush or liner, e.g. by transverse forces, changes of the chamfer and of dimensions are caused so that whole batches of bearing elements are found to be outside the tolerance regions and must be classified as reject. Additional processing of the finished product is generally not possible.

The wide strip and the narrower strip cut therefrom and with it also the plain bearing elements have a steel backing, which is e.g. copper plated, and on it applied laminar material, either of bronze or a layer of a mixture of plastics or similar material. The described method and also the described apparatus start from a common technology in which a wide strip of the described kind is as a large coil longitudinally cut in a machine for longitudinal cutting, e.g. circular shears, such that several - at least two - mutually parallel narrower strips are produced. These are made in the form of coils, i.e. individual coils, on the wind-on device of the station for longitudinal cutting. These individual coil are in sequence individually safeguarded against resilement, generally by binding with wire or bonding with adhesive tapes. The relevant individual coil is then put aside and for further treatment it is useful to position between the first coil put aside and the subsequent individual coil wooden blocks as spacers so that a stacking device or similar machines can better ensure transport from one machine or station to another.

Finally according to the known method the respective individual coil is profiled, i.e. a chamfer is made on two opposed longitudinal edges and sometimes even on all four longitudinal edges of the strip, either by rolling or by machining. After profiling the strip of the respective individual coil is again wound onto the wind-on device, bound and put aside in the described manner. Then the profiled individual coil is brought finally to the bearing

bush wrapping automatic device or another follow-up machine and is there processed. After the processing overstepping of the tolerances is detected in some of the bearing elements which stems partly from the fact that the metal strip of the respective individual coil has incorrect chamfer geometries or incorrect thicknesses. If such errors are detected in the measuring station, the whole batch of individual coils may have to be treated as rejects. Additional treatment of the individual strips is generally not possible, and when it is, it is very expensive.

Apart from the mentioned high expenses the known method has the additional disadvantage that the production times are altogether relatively high. The binding of the individual coils, their putting aside, transport and new winding onto the respective wind-off device of the subsequent processing machine require considerable nonproductive times which add up and in comparison with the processing proper of the wide strip from the large coil to the finished product, i.e. the plain bearing element, are in no feasible proportion.

This was partly realised and from the individual coils was formed a so-called endless strip in which the strip of one individual coil was welded to another and the area of the weld was ground. Such a composite strip has a considerable length which may be compactly wound onto a transfer winding device, which has, however, the main disadvantage, that the whole material on the transfer winding device had to be treated as reject due to irreparable chamfer geometry, remained.

The aim of the invention is therefore to further develop, rationalize and simplify the known method and the known apparatus such that the total production time is shortened and rejects considerably reduced.

As regards the method this aim is achieved

in that the longitudinally cut strips are brought as a block of coils from a wind-on device of the station for longitudinal cutting to the profiling stations where first at least one profiling is made on the steel backing and then at least one profiling in made on the laminar material of the strip, whereupon the strip, which has been profiled in this way, is fed to a follow-up machine in which it is formed into plain bearing elements, immediately after the formation is measured for accuracy and the profile of the strip is altered according to the result of the measurement.

According to the invention after the longitudinal cutting of the wide strip removed from the large coil the respective individual coil is not bound and put aside but the whole of the mutually parallel, longitudinally cut strip is wound to form a block of coils, the size of which may be approximately compared to the size of the large coil and in which all the strips formed by the longitudinal cutting are arranged next to and parallel to each other. To avoid resilement, even in this case the block of coils on the wind-on device of the station for longitudinal cutting must be safeguarded, e.g. by radial and longitudinal adhesion over the periphery. the whole coil or the whole block of coils is, however, according to the invention removed and brought on the wind-off device to the profiling machine with rounding and/or chamfering stations. In front of the chamfering stations several individual coils are now positioned together in a block of coils on the wind-off device, as was the case with the earlier mentioned and proposed older method using the transfer winding device. The manipulation and transport work from the station for longitudinal cutting to the profiling machine are thereby considerably shortened and simplified, which results in a first improvement of the efficiency of the new method.

It is further advantageous that now,

according to the invention, first at least one chamfer is rolled-on on the steel backing and at least one further chamfer is made by cutting knives, namely on the laminar material. This chamfering is performed continuously in a manner known per se. In contrast to known methods, the profiled metal strip is then, more or less immediately after the completion of its profiling, brought into the automatic device for the wrapping of bearing bushes where it is processed into plain bearing bushes. According to the immediately thereafter following measuring the results of measurement may advantageously be immediately used for the alteration of the chamfering of the metal strips in the profiling machine.

In contrast to the known or older methods it is now not necessary to classify the whole batch with several individual coils of metal strips as reject, but corrections in the cutting station may immediately be made so that practically only a relatively small number of plain bearing elements become rejects outside the tolerance region. Only a few meters of material from the individual coil, which is being processed and is e.g. 2000 m long, have been processed up to that moment. Rejects are thereby reduced by the method according to the invention considerably.

Within the framework of the invention it is particularly advantageous when by the profiling a chamfer is rolled on the steel backing and machined on the laminar material side.

It is further advantageous according to the invention when the block of coils is arranged on a sleeve, individually bound against resilement and for the insertion of the strip into the chamfering stations the binding of the relevant individual coil on the wind-off device of the chamfering stations is removed. The wound-on strip has, as before, the tendency to resile. The individual coil had to be

safeguarded against it as now the block of coils is safeguarded against it, but the method according to the invention has the advantage that only one block of coils has to be processed and also correspondingly transported, whereby considerable nonproductive times are saved. To obtain again from the block of coils on the wind-off device of the chamfering stations an individual coil and to make its strip available for processing, this safeguarding or binding of the individual coil may, according to the invention, be sequentially removed without new nonproductive times being needed for the change from the previous to the next individual coil. If the safeguarding against resilement, i.e. binding, was obtained e.g. by adhesive tapes stuck over the periphery, the operator can very easily release this safeguarding of the strip by cutting with a knife along the periphery. The remaining individual coils in the block remain thereby united and can neither resile nor collapse.

It is further advantageous according to the invention if in the region of the chamfering stations, the strip is partly pulled and partly pushed. It is understood that the respective strip from the individual, separated coil on the wind-off device downstream of the chamfering stations runs continuously through these stations so that it is advantageous for the manufacture of the corresponding profiling machine and also for its use when the strip is pulled from the wind-off device and after this pulling drive is pushed, looking in the direction of processing, to the further chamfering stations and processing stations. This follows already from reduction of the number of drives achieved thereby.

The invention is advantageously further carried out in that during the running out of the previous strip the next strip is separated and inserted into the chamfering stations. When, during the manufacture, a strip from one individual coil is

processed and pulled off a wind-off device, the beginning of the next following strip can be inserted into the first station of the profiling machine after separation of the next following individual coil, already during the last meters of the previous strip in the described manner. As far as this processing could be referred to as discontinuous processing, it has been shown in practice that in general only a few centimetres lie between the end of the previous strip and the beginning of the next following strip inserted into the profiling machine. The follow-up machine will be idling only through several tacts.

It is further advantageous, according to the invention, that the geometry of the chamfers and/or the thickness of the strip may be changed during the chamfering. Not only the chamfer geometry of the strip being processed but also its thickness - at least within certain tolerances - may be changed by a method according to the invention during production. This makes the manufacturing process versatile and economically very advantageous.

As regards the apparatus for the production of the plain bearing bushes the aim is achieved according to the invention in that the profiling machine comprises a wind-off device for receiving a sleeve with the longitudinally cut coiled wide strip and, in the direction of movement of the strip, downstream thereof the driven chamfer rolling station and downstream thereof the cutting station. The profiling station has therefore, according to the first characterising feature, a wind-off device which is not only suitable for receiving individual coils but is so dimensioned that it may take a large coil; however with the difference that a wide coil longitudinally cut according to the invention is taken, i.e. the block of coils including the sleeve. This considerably improves the possibility of manipulation and the above mentioned advantages intended to be achieved by

the invention have a much better effect.

In the production of the coiled wide strip, and with it also of the strip of the individual coils, there is continuously on the one side the steel side and on the other the laminar material side, while in the order according to the invention the strip gets first with its steel side into contact with the chamfer rolling station and - viewed in the direction of processing or strip movement - downstream thereof is the cutting station which comes into contact with the laminar material side.

In a further development of the invention a post-rolling machine for the thickness of the strip is situated between the follow-up machine, e.g. the automatic device for the wrapping of bearing bushes, and the cutting station. Before the finished strip, provided on the steel side with a rolled and on the laminar side with a cut chamfer, is introduced into the automatic device for the wrapping of bearing bushes, it passes through the post-rolling device which still belongs to the profiling machine. If necessary, the strip thickness can be additionally rolled in this device, but the correction may be made only in the region of hundredths of a millimetre. Otherwise there is a danger that the rolling might disturb the bond between the steel backing and the laminar material. The strip processed according to the invention is of a composite material in which e.g. a porous sintered bronze on chromium-plated steel forms the backing. Excessive post-rolling could undesirably compress the cavities in the laminar material in which was anchored the plastics layer. If needed, the post-rolling device can influence the thickness in the manner of polishing.

The apparatus according to the invention is preferably further made in that the take-off device of the profiling machine is without a drive and is provided with braking means. It represents a

considerable effort in construction to drive a winding device, or a considerable effort can be avoided when, according to the invention, the winding device requires no drive. In a known method and apparatus the wind-off device had to be always driven to permanently maintain or form a sagging portion of a certain size. By the design of the chamfering stations according to the invention the wind-off device of the profiling machine is only braked, because the strip runs from it directly through the individual chamfering stations without the interposition of a sagging portion.

In the profiling machine is provided a drive of the chamfering stations and the winding-off device should therefore have braking means.

In a further advantageous embodiment of the invention the chamfer rolling station comprises a driven profiled upper roller and a driven cylindrical support roller. The upper roller may be a so-called composite roller, i.e. rolling rings and spacing rings may be assembled or attached for various strip widths. The rolling surfaces of the rolling rings have e.g. the form of frustoconical jackets with adjustable angles which correspond to the desired chamfer angle.

The support roller is a cylindrical smooth roller by means of which the rolling force is introduced into the strip. For instance the burr produced during the longitudinal cutting of the wide strip, a so-called inner cut burr, can be pressed away with the help of the cylindrical support roller (because it is present at the laminar material side).

The drive rollers of the chamfer rolling station pull thereby on the one hand the strip from the wind-off device of the profiling machine and pull on the other hand the metal strip through the following cutting station.

Both the profiled upper roller and the

cylindrical, smooth support roller are mounted on the driving gear such that they are cantilevered. i.e. mounted on one side and overhang. This has for the invention the advantage that the machine can be retooled much faster. As an example, the individual parts are well accessible, the spacing rollers may be removed and replaced by others in shorter time.

Means which enable the upper roller to be displaced relative to the support roller such that the distance between them may be altered are further provided in the region of the gear of the chamfer rolling station according to the invention. For instance a spindle cooperates with the slide of the upper roller by the turning the spindle the axes of the upper and support rollers may be moved towards or away from each other with an accuracy of one hundredth of a millimetre. The rolling region of the rolling profile can thereby by advantageously influenced. In other words, the chamfer size my be corrected by the actuation of the spindle. A person skilled in the art will understand that e.g. the depth of influence of the rolling rings may be increased and thereby also the rolled chamfer might be increased when the axes of the upper and support rollers are brought nearer to each other. This is according to the invention clearly possible even during processing.

It is further advantageous according to the invention when two cutting knives are displaceably and tiltably mounted in the cutting station. One of the knives cuts one of the chamfers and the other the opposite chamfer. It has already been mentioned earlier that the chamfering on the laminar material side is performed by cutting. If these, so-called inner chamfers (because they are later e.g. in the plain bearing bush situated inside), certain corrections may be made by the adjustability of the cutting knives even during processing.

Alteration of the angle of setting of the cutting knife with respect to the strip passing through may be achieved during processing particularly in that, in a further embodiment of the invention, the cutting knife is releasibly clamped on a tiltable holder which is resiliently pretensioned and adjustable by screws or similar means, the holder being, via a tilt line, supported on a displaceable support block. The tilting is performed by the adjustment of clamping screws and retaining screws and may be very finely achieved during processing by a small manual adjustment. If another cutting area of the cutting knife is intended to be brought into engagement with the strip, then all that is necessary is to release the clamping plate, to move the knife in its longitudinal direction and then to firmly fix the clamping plate again.

It is useful according to the invention when the post-rolling device comprises two rollers, the mutual spacing of which is adjustable and which are driven with a slip by the chamfer rolling station, and distance measuring devices, and when, preferably, the rollers of the chamfer rolling station are free-running. This ensures during the operation of the post-rolling station that the strip between the post-rolling station and the chamfer rolling station is always tight.

It is also advantageous according to the invention when the cutting knives are arranged on the side of the strip opposite to the upper roller of the chamfer rolling station for engagement with the strip and are with respect to each other in staggered arrangement in the direction of movement of the strip. This has the advantage that when the change of the chamfer geometry is needed on one chamfer, the other chamfer remains thereby uninfluenced.

By the splitting of the cutting station in two units, each with one cutting knife, the design,

fixing and displacement of the cutting knives is understandably simple.

When the strip runs out, the beginning of the next individual coil is simply inserted up to the chamfering station and pushes from there the previous strip forward.

Further advantages and possibilities of application of the present invention will be apparent from the following description of a preferred embodiment in connection with the drawings, in which:

Figure 1 shows, in perspective and simplified, a profiling machine,

Figure 2 shows diagrammatically a plan of a profiling machine from a wind-off device on the right up to a post-rolling device on the left,

Figures 3 to 6 show cross-sections corresponding to positions A-A to D-D of the strip in Figure 2, and

Figure 7 shows a partly broken away view of a cutting station, approximately along the line B-B in Figure 2.

Figure 1 shows a profiling machine 8 which comprises a wind-off device 9, a chamfer rolling station 12, a chamfer cutting station 13 and a post-rolling device 14. The individual stations cause that a profile is produced on an unprofiled strip 2 taken off from the wind-off device 9. The function and operation will now be described.

Behind the front wall 1, shown on the left in Fig. 1, are situated a follow-up machine (not shown), e.g. an automatic device for the wrapping of bearing bushes, and measuring devices (not shown) for the measuring of the finished plain bearing bushes. Also a station for longitudinal cutting with a wind-off device, circular shears and a wind-on device are not shown because these devices are known to a person skilled in the art per se.

Chamfered plain bearing bushes are made in

the automatic device for the wrapping of bearing bushes behind the front wall 1 from a strip 2 which is composed of a steel backing 50 and laminar material 51 and whose direction of movement or processing is in Figures 1 and 2 indicated by an arrow 3. The strip 2 travels from the wind-off device 9 in the form of individual coils 4,5,6 in the direction of movement 3 up to the slot 7 in the front wall 1 of the automatic device for the wrapping of bearing bushes.

For better understanding of the invention the profiling machine 8 will now be described (see Figures 1 and 2 and a detail in Fig. 7).

The wind-off device 9 carries a sleeve 9' on which is situated a longitudinally divided large coil in the form of a block 11 of coils composed of individual coils 4,5,6 etc. In Figures 1 and 2 is not shown the binding between the individual coils 5 and 6. The device 9 has a stand mounted in guide plates 10 for the displacement of the wind-off device 9 always by the width of the strip 2. The transport movement of the strip 2 is obtained by the chamfer rolling station 12. In the direction of movement 3 of the strip 2 downstream of the station 12 is situated the chamfer cutting station 13 and downstream of that the post-rolling device 14.

<u>Chamfer rolling station 12</u>

The chamfer rolling station 12 has a slide 15 with a gear 16 for the floatingly mounted upper roller 17 and the cylindrical smooth supporting roller 18. The shafts 21,21' of the upper roller 17 and support roller 18 are arranged displaceably relative to each other by the spindle 19 with a hand wheel 20, although both the rollers 17,18 are driven synchronously with each other. A free-wheel arrangement (not shown) is preferably provided in the gear 16.

The upper roller 17, a so-called composite roller, is composed of spacing rings 22 and also rol-

ling rings 23 spaced from each other by the width of the strip 2. The upper roller 17 can thereby make a profile on the strip 2 according to the steel-side chamfer 24,24' shown in Figure 4.

<u>Chamfer cutting station 13</u>

The cutting station 13 is made in two parts such that the (in the direction of movement 3 of the strip 2) front station 26 holds a first cutting knife 27 and the second cutting station 26', situated downstream thereof, holds a second cutting knife 27' located on the opposite side. Apart from the mirror-image arrangement, the two cutting stations 26 and 26' are of the same construction so that it is sufficient to describe only the station 26 with the cutting knife 27, particularly in connection with Figure 7, direction of viewing Figure 2, section B-B.

On a supporting section 28 are fixed four columns 29 on which are displaceably arranged a support block 30 and a support member 31 spaced from each other. The support block 30 incorporates a carrier 32 provided with two guide rollers 33 (one above and one below the strip 2) which are arranged rotatably about the axes shown in chain-dotted lines and serve for rough vertical guiding of the strip 2. On the carrier 32 is in addition mounted a further lateral, flat guiding roller 34 for the lateral guiding of the strip 2 about a chain-dotted vertical axis of rotation shown perpendicular to the two chain-dotted axes of rotation of the rollers 33. In Figures 1 and 2 can be seen further lateral, flat guide rollers 34' which are situated on the opposite side on the support member 31, so that the strip 2 is accurately guided from both sides. The lateral guiding is completed by a vertical guide of which only the upper guide rail 35 is shown in Figure 7, the latter guiding the strip 2 from above. The rail is a fixed, stationary rail 35 which prevents the strip from moving upwards.

The cutting knife 27 is releasibly mounted on a tiltable holder 37 by a clamping plate 36 which may be firmly fixed by screws (not shown). This tiltable holder 37 is supported on the support member 32 by a tilt line 38. The support member 31 has on the (in Figure 7) right-hand side of the tilt line 38 a blind hole 39 for a compression spring 40 which is slid over a guide pin 41. The lower end of this compression spring 40 bears against the bottom of the blind hole 39 in the support member 31 and the opposite end against a planar inclined surface 42 of the tiltable holder 37. The force of the compression spring 40 therefore tends to turn the tiltable holder 37 anticlockwise about the tilt line 38.

Against it works a locking screw 44 about the shaft of which is slid a further compression spring 43. This locking screw 44 is situated in a hole 45 in the tiltable holder 37, while the front end of the shaft of the locking screw 44 is firmly screwed into a further blind hole in the support member 31. The compression spring 33 bears on the one hand against the bottom of the hole 45 in the tiltable holder 37, which has a larger diameter, and on the other hand against the head of the locking screw 44.

A further locking screw 46, which extends substantially through a hole in the tiltable holder 37 and the shaft end of which is screwed in a blind hole in the support member 31, allows tightening and clockwise turning of the tiltable holder 37 about the tilt line 38. A retaining screw 47 enables the adjusted angular position of the cutting knife 27 to be retained.

It will be appreciated that even in operation when the strip 2 is inserted in the machine, the set angle of the cutting knife 27 with respect to the strip 2 may be altered by the displacement of the screws 44,46,47. When the retaining screw 47 or the

locking screw 46 are loosened, the compression spring 43 or 40 exerts a pretensed clamping of the tiltable holder 37.

<u>Post-rolling device 14</u>

The post-rolling device 14 comprises two smooth rollers 52,53, the mutual spacing of which is adjustable and which are driven by the chamfer rolling station, and dial gauges 54,55 for the measurement of the mutual spacing of the two rollers 52,53.

The strip 2 and its outer alteration is shown and explained in connection with Figure 2 and also Figures 3 to 6. As has already been mentioned, the strip 2, is composed of a steel backing 50, which is also called steel back, and a laminar material 51 applied thereon, e.g. a bronze with or without a plastics mixture or similar material.

When looking on the strip 2 in Figure 2, one can see the steel backing 50 in Figures 3 to 6 on top.

Figure 3 shows the unprofiled strip 2 of the individual coil 4 as it is at section line A-A in Figure 2, while inner cutting burrs 25 produced by the knife of the circular shears (not shown) are visible on the sides of the laminar material 51.

The strip 2 shown in Figure 3 is pulled into the chamfer rolling station 12. In it, as described above, the steel backing 50 is provided on one side with the chamfer 24 and on the opposite side with the chamfer 24', as is shown in Figure 2 at the section line B-B in Figure 2. The inner cutting burrs 25 are ironed out by the roller 18 as is shown at 25".

After the strip 2 has been finally processed on the steel side in the chamfer rolling station 12, the strip 2 travels further into the chamfer cutting station 13, first into contact with the first cutting knife 27. The section line C-C in Figure 2 cuts the strip 2 at a cross-section shown in Figure

5. The chamfer 56, made on one side in the laminar material 51 by cutting, may be seen. This is not so on the opposite side and the strip 2 therefore during its further movement in the direction 3 gets into contact with the second cutting knife 27' whereby the opposite chamfer 57 is made in the same way (Figure 6 and Figure 2, section line D-D).

In the region D-D in Figure 2 the strip 2 has its final profile.

In some circumstances a small reduction of the thickness of the strip may be achieved by the post-rolling device 14 or its smooth rollers 52.53. The final state of the strip 2 is thereby in the region downstream of the post-rolling device 14.

CLAIMS

1. A method for the manufacture of profiled plain bearing elements in which a coiled wide strip, composed of a steel backing and a laminar material applied thereon, is longitudinally cut into strips in the form of coils and is then longitudinally profiled and processed into plain bearing elements, wherein the longitudinally cut strips are brought as a block of coils from a wind-on device of the station for longitudinal cutting to profiling stations where first at least one profiling is made on the steel backing and then at least one profiling in made on the laminar material of the strip, whereupon the strip, which has been profiled in this way, is fed to a follow-up machine in which it is formed into plain bearing elements, immediately after the formation each element is measured for accuracy and, if necessary, the setting of the profiling stations and consequently the profile and/or the thickness of the strip is altered according to the result of the measurement.

2. A method according to claim 1, wherein by the profiling a chamfer is rolled-on on the steel backing and machined on the laminar material side.

3. A method according to claim 2, wherein the block of coils is arranged on a sleeve on the wind-on device of the station for longitudinal cutting and individually bound against resilement, and for the insertion of the strip into the profiling stations the binding of the relevant individual coil on the wind-off device of the profiling stations is removed.

4. A method according to any one of claims 1 to 3, wherein in the region of the profiling stations the strip is partly pulled and partly pushed.

5. A method according to claim 4, wherein the profiling stations are in the form of chamfering stations.

6. A method according to any one of claims 1 to 5, wherein during the running out of the previous strip the next strip is separated and inserted into the chamfering stations.

7. A method according to any one of claims 1 to 6, wherein the geometry of the chamfers and/or the thickness of the strip are changed during the chamfering.

8. An apparatus for the manufacture of profiled plain bearing elements, in which, in a station for longitudinal cutting, a coiled wide strip, composed of a steel backing and a laminar material applied thereon, is formed into strips in the form of at least two coils and in which at least two longitudinal edges are profiled, the apparatus comprising

- a profiling machine which is situated, in the direction of processing, downstream of the station for longitudinal cutting and contains profiling stations,
- a follow-up machine situated downstream of the profiling machine, and
- measuring means for the measurement of the finished plain bearing element,

wherein the profiling machine comprises a wind-off device for receiving a sleeve with the longitudinally cut coiled wide strip and, in the direction of movement of the strip, downstream thereof the driven chamfer rolling station and downstream thereof the chamfer cutting station.

9. An apparatus according to claim 8, wherein the profiling stations are chamfering stations including a chamfer rolling station and a chamfer cutting station with cutting knives.

10. An apparatus according to claim 8 or 9, wherein a post-rolling machine is situated on the profiling machine between the follow-up machine and the chamfer cutting station.

11. An apparatus according to any one of claims 8 to 10, wherein the wind-off device of the profiling machine is without a drive and is provided with braking means.

12. An apparatus according to any one of claims 8 to 11, wherein the chamfer rolling station comprises a composite profiled upper roller and a cylindrical support roller which are driven in synchronism and move relative to each other.

13. An apparatus according to any one of claims 8 to 12, wherein two cutting knives are displaceably and tiltably mounted in the chamfer cutting station.

14. An apparatus according to claim 13, wherein the cutting knife is, via a clamping plate, releasibly clamped on a tiltable holder which is resiliently pretensioned and adjustable by screws or similar means, the holder being, via a tilt line supported on a support block displaceable on columns.

15. An apparatus according to claim 10, wherein the post-rolling device comprises two rollers and distance measuring devices and 13A. An apparatus according to claim 13, wherein the rollers of the chamfer rolling station are free-running.

16. An apparatus according to claim 13 or 14, wherein the cutting knives are arranged on the side of the strip opposite to the upper roller of the chamfer rolling station for engagement with the strip and are with respect to each other in staggered arrangement in the direction of movement of the strip.

17. A method according to claim 1 substantially as herein described with reference to the accompanying drawings.

18. An apparatus according to claim 8 substantially as herein described with reference to, and as shown in, the accompanying drawings.

19. A profiled plain bearing element made by an apparatus according to any one of claims 8 to 16 or 18.

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